



# **Development of Water Quality Standards for Willard Spur**

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## **Conclusions and Next Steps**

**January 11, 2016**



# Presentation Outline

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Important Science Panel Conclusions

Managing Risk

Next Steps: WQS Revisions





# Overarching Conclusions

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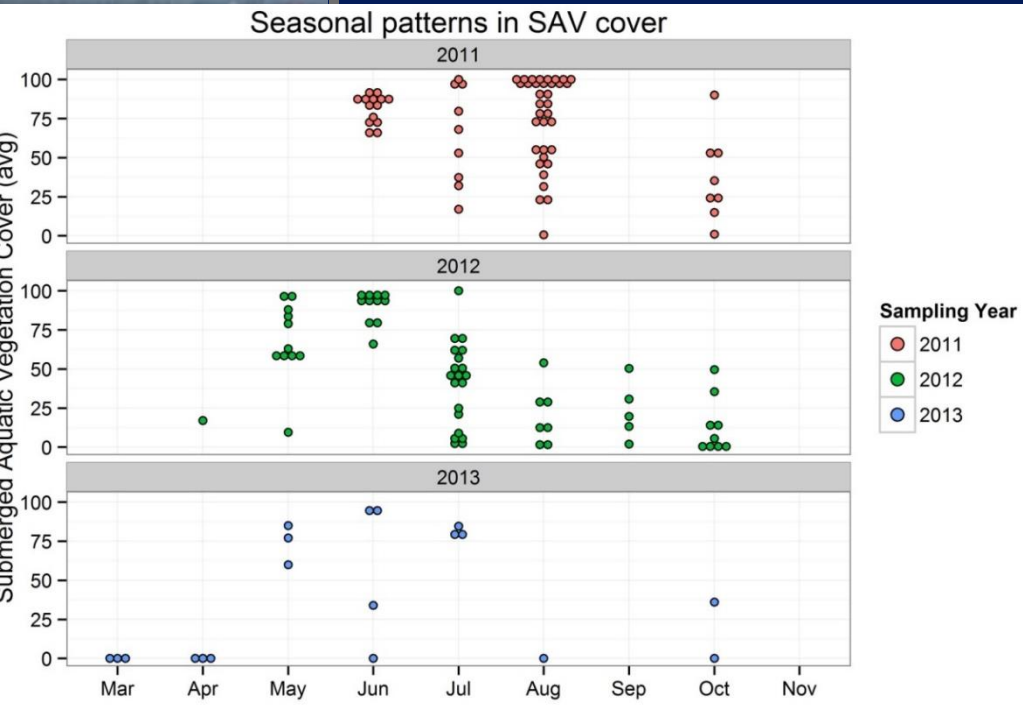
Unless things change, high confidence of minimal threat from the POTW discharge

Confidence is lower depending on future changes



# Is the Spur Meeting it Uses?

Yes, both of them!



...at least under current conditions.

# Clear Water Phase



- SAV importance:
  - Habitat, Base of Food Web
    - Piscivorous Avifauna
  - Ecosystem Service: Nutrient Removal
    - Internal nutrient cycling
    - Low water column nutrients
    - Low sediment nutrients

# Green Water Phase

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- SAV Senescence
  - Nutrient Cycling back to Water Column and Reproductive Structures (tubers & drupelets)
  - Denitrification: N to Atmosphere
  - Shorebird Avifauna



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# Is the Resilience Sustainable?





# Conclusions that Suggest Minimal Concern

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- Little evidence of year-to-year accumulation of nutrients
  - Flushing flows are protective
- POTW sources are small relative to others
  - Sometimes doesn't reach the open waters
- Uptake  $\gg$  Inputs
  - Especially in early growing season

On one hand...





# Conclusions that might be Concerning

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## ■ Observations of SAV Collapse

- Largely driven by hydrologic isolation and associated changes in habitat (increase in pH, temperature, salinity)
- Could nutrients exacerbate these problems?

## ■ Experimental Evidence

- Early: moderate/high = depressed growth
- Later: high = decrease in SAV condition

## ■ Low Nutrient/High Production Condition is Unique

- Does it warrant explicit protection?

On the other hand...





# Reconciling the Evidence

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- Experimental Results Suggest that Water Column Numeric Nutrient Criteria are not Appropriate for the Spur
  - Uptake is so high that increases in water column nutrients were not measurable
  - Yet, harm is possible before measurable increases in water column nutrients could be observed
  - But, current conditions seem healthy
  - And, the low nutrient additions did not result in measurable effects

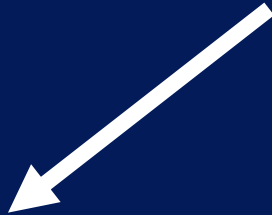
So what to do?



# Minimize Risk

**Risk = Probability**

*Chance of undesirable condition*



- Identify potential threats
- Identify measures can be applied to decrease the chance of negative consequences

**\* Outcome**

*How bad are the consequences?  
e.g., death > pain*



- Identify worst and best-case scenarios
- Identify important causal agents to minimize bad (or maximize good) outcomes



# The Importance of Hydrology

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## 1. It is critically important to maintain the flushing flows

- Prevent accumulation of nutrients and organic matter
- Increases the ability of the Spur to mitigate nutrient inputs

## 2. Size Matters

- The ability of the Spur to process nutrients and support aquatic life depends upon the size of the open water pool

## 3. Failure to Address this may Trump all other efforts

*Recommendation: Seek opportunities to increase water inputs, especially in June-July of dry years*





# Is there a Sensitive Period?

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- Minimal Risk of Nutrients during Hydrologic Connection
  - In dry years: October through early-mid June; In wet years: NA?
  - Helps with nutrients, but more importantly minimizes the threat of other stressors (i.e., pH, temperature, salinity)
- Risk Increases Mid-Late Growing Season (Dry Years)
  - Ambient nutrients are higher
  - Assimilative capacity is lower
  - If the Spur is isolated, mid season may be particularly important (nutrients + other stressful conditions)

*Recommendation: Focus any nutrient-related BMPs in July-September*



# Is it Nitrogen or Phosphorus?

Table 2. A comparison of measured C:N:P in organic matter pools against literature screening values (see Table 2) for nutrient limitation and algae growth rates.

Pool	Molar Ratio	Clear Water Phase		Green Water Phase		Comment
		+SAV	-SAV	+SAV	-SAV	
Seston (phytoplankton)	N:P	4.29 (±1.31)	6.21 (±0.41)	45.54 (±12.08)	88.37 (±8.76)	P deficient
	C:N	12.5 (±2.74)	10.55 (±1.53)	9.67 (±1.53)	8.40 (±1.06)	N deficient
	C:P	51.33 (±6.77)	65.61 (±11.33)	454.62 (±93.62)**	317.67 (±59.83)**	P deficient
Epiphytes	N:P	14.72 (±2.74)++		10.36 (±6.04)++		High Growth Rate
	C:N	11.78 (±0.45)		37.30 (±2.20)**		N deficient
	C:P	173.29 (±23.12)		379.97 (±18.45)**		P deficient
SAV <sup>1</sup>	N:P	78.94 (±22.67)		51.04 (±15.79)		P deficient
	C:N	14.3 (±0.53)		32.99 (±1.85)**		N deficient
	C:P	126.05 (±309.66)**		1701.11 (±590.60)**		P deficient
Sediment (periphyton)	N:P	24.24 (±4.67)	35.57 (±8.40)	23.99 (±20.24)	11.07 (±6.11)++	P deficient
	C:N	30.12 (±4.51)**	26.42 (±2.50)**	21.55 (±7.18)++	15.96 (±1.77)**	N deficient; High growth
	C:P	718.81 (±88.72)**	941.44 (±259.70)**	431.92 (±195.26)**	182.62 (±118.68)**	P deficient

<sup>1</sup>While algae ratios are not directly comparable to SAV, they are applied here as a point of reference. Red text signifies P deficiency, whereas blue text signifies N deficiency. \*\*Indicates strong, as opposed to moderate deficiency. ++Indicates high growth rate.

Both are important, but P seem more so late in the growing season



# Minimizing Risk: Land Application

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- The discharge point matters
  - Moving the discharge to adjacent land eliminates the risk, especially if plant material is harvested
- Creating habitat for birds and wildlife would be an added benefit
  - Note: This was not discussed with the Science Panel, but has surfaced subsequent to our discussion
  - It does reflect the tenor of the discussions

*Recommendation: Land apply if possible, avoid spread of phragmites*





# Monitoring

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- Needed to track changes
- Water column nutrients are likely not the most sensitive indicator, instead:
  - Plant nutrient concentrations
  - Sediment nutrient concentrations

*Recommendation: Implement Long-term Monitoring*





# Discuss Final Conclusion to WQB

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Does the POTW Discharge Threaten the Spur's Uses?

- The immediate question
- Address via Permit Renewal

What is needed to ensure the long-term protection of the Spur uses?

- Next steps





# Does the POTW Threaten Uses?

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## Let's dissect and wordsmith the following:

The Science Panel and the Steering Committee agree on the following:

- The Spur is a unique and important ecosystem that warrants protection
- The current POTW discharge poses minimal risk to the support of the Spur's uses, provided that,
  - Monitoring efforts are established to identify unforeseen circumstances (ongoing vigilance)
  - Inputs of Phosphorus should be minimized, to the extent practicable, during sensitive periods
  - Management should maintain the current hydrologic regime of the Spur, especially the yearly flushing flows and acknowledge that the permit conditions might need to change if changes occur





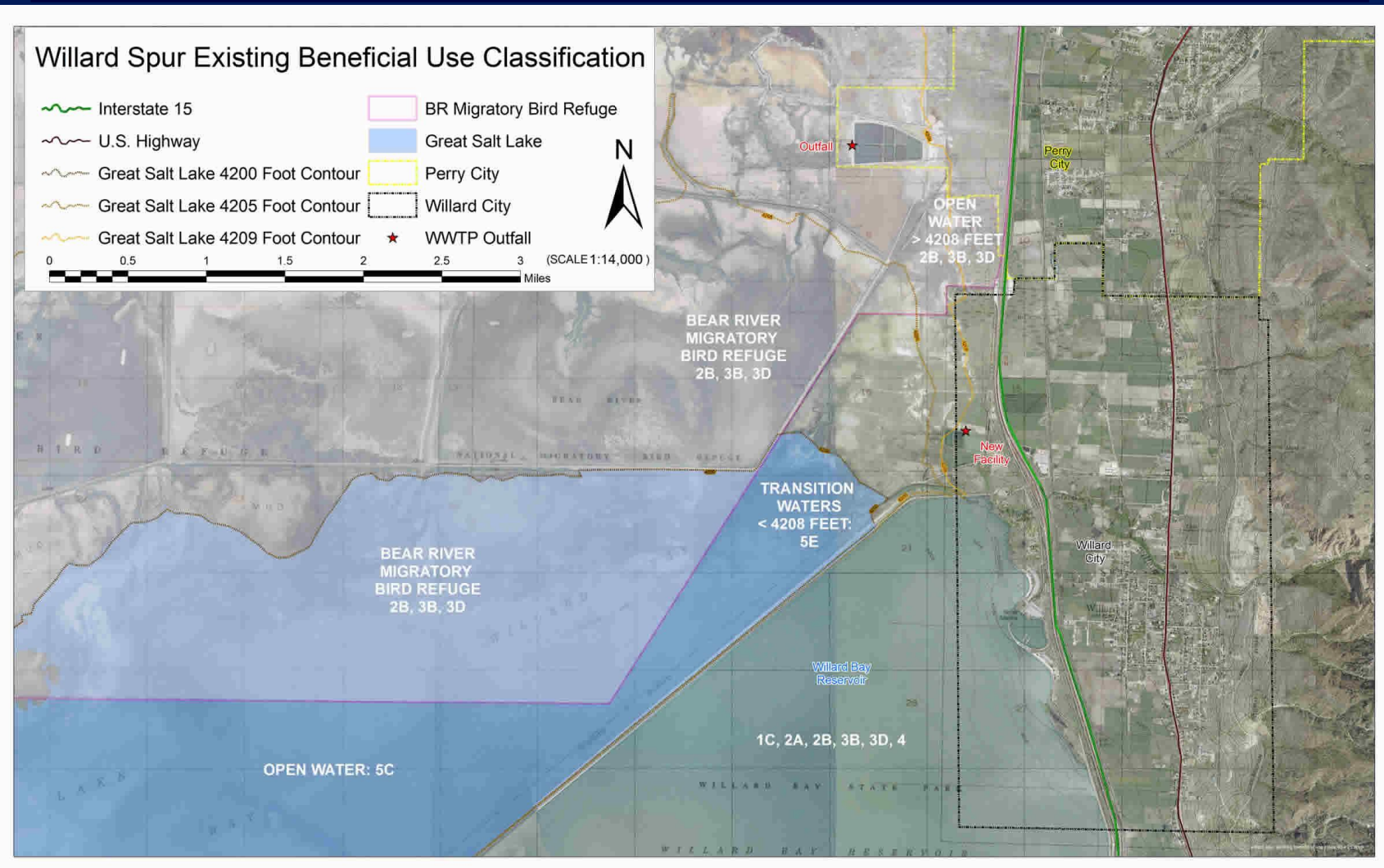
# Next Steps: Changes to WQSs

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*What is needed to ensure the long-term support of Willard Spur Uses?*



# Current Classification Map



# Beneficial Uses of Willard Spur

Class	Use
2B	Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.
3B	Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
3D	Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
5C	Open waters of Bear River Bay at or below an elevation of 4208 feet. Protected for infrequent primary and secondary contact recreation, waterfowl, shorebirds, and other water-oriented wildlife including their necessary food chain.
5E	Transitional waters on Great Salt Lake shoreline at or below an elevation of 4208 feet. Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.

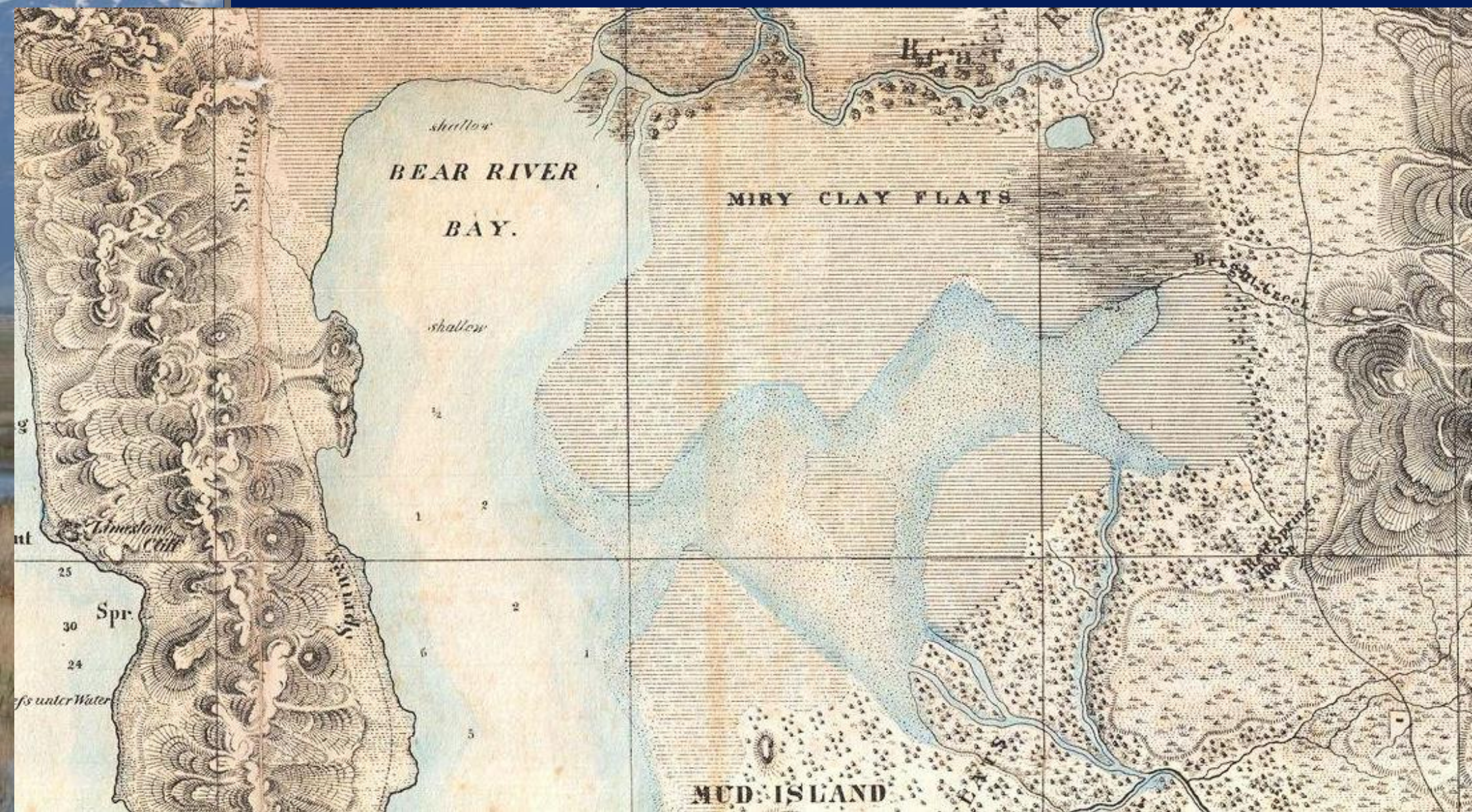




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*Should the Spur  
Boundaries Exclude the  
Tailrace?*



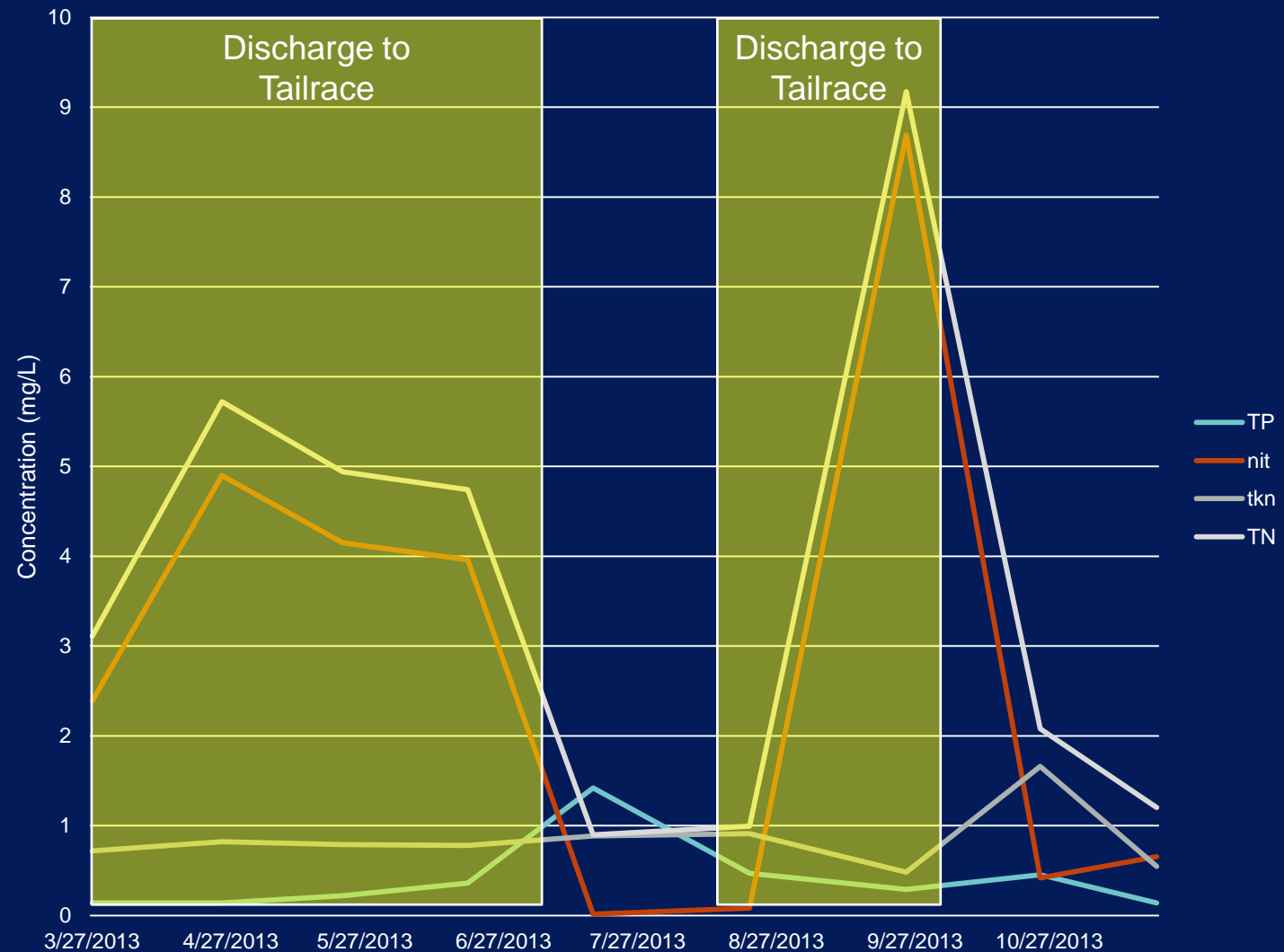


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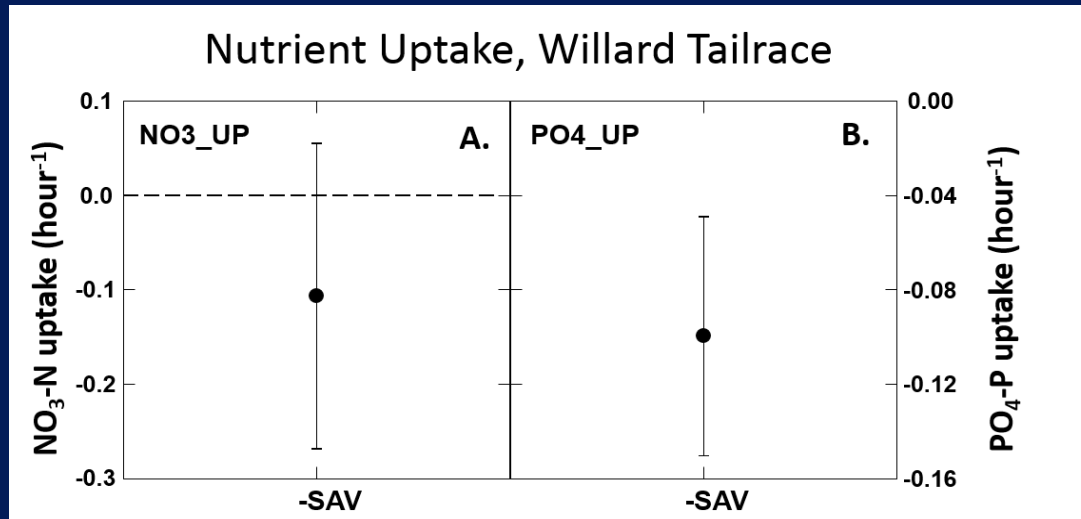




# Why does this matter?

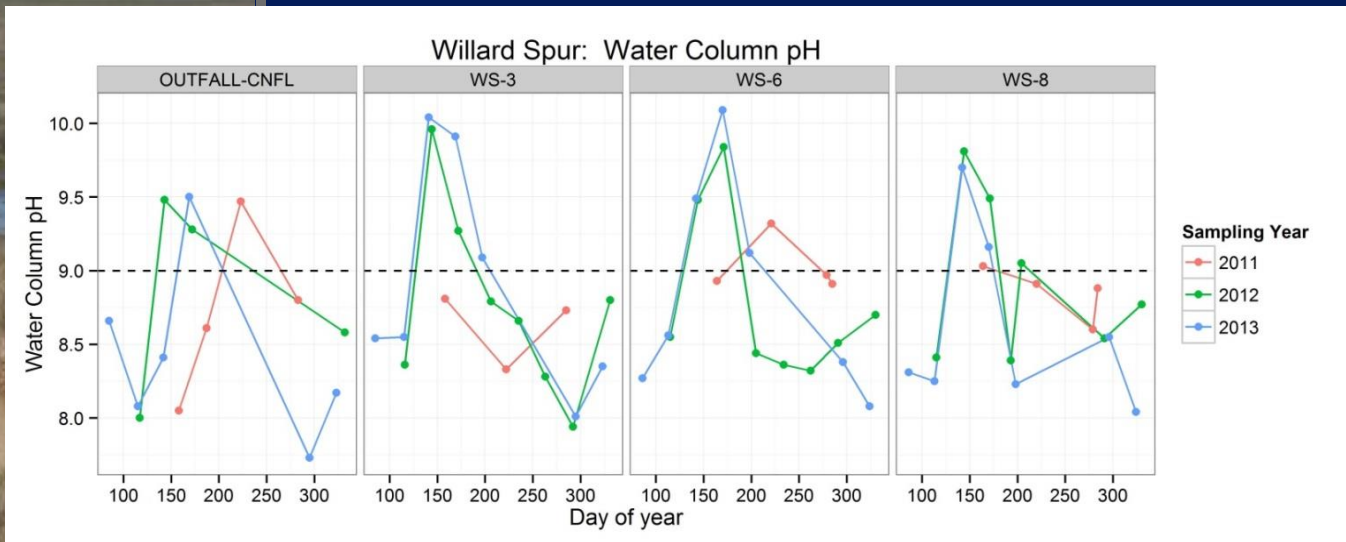


# What Proportion of Nutrients Get to the Open Water?



# Issues with 3B Classification

## Need to Address Natural WQS Violations



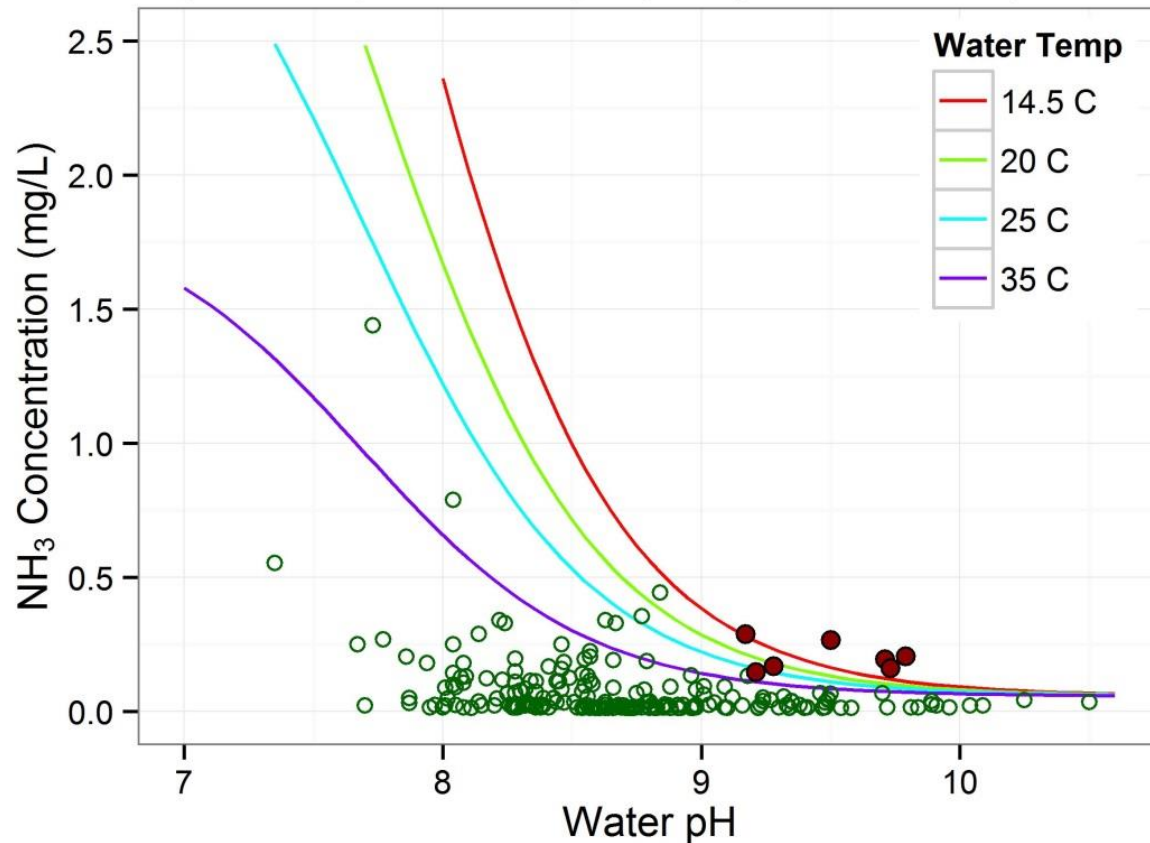
56 Samples  
with pH > 9.0

Also temperature and DO



# Issues with 3B Classification

NH<sub>3</sub> Toxicity Criteria (3B) vs pH and Temperature



7 exceedances for NH<sub>3</sub>

Driven by:

- Warm Temps (> 28.5 C)
- High pH (> 9.17)
- Elevated NH<sub>4</sub><sup>+</sup> (> 80<sup>th</sup> percentile)

All within the eastern portion of the Spur





# Options

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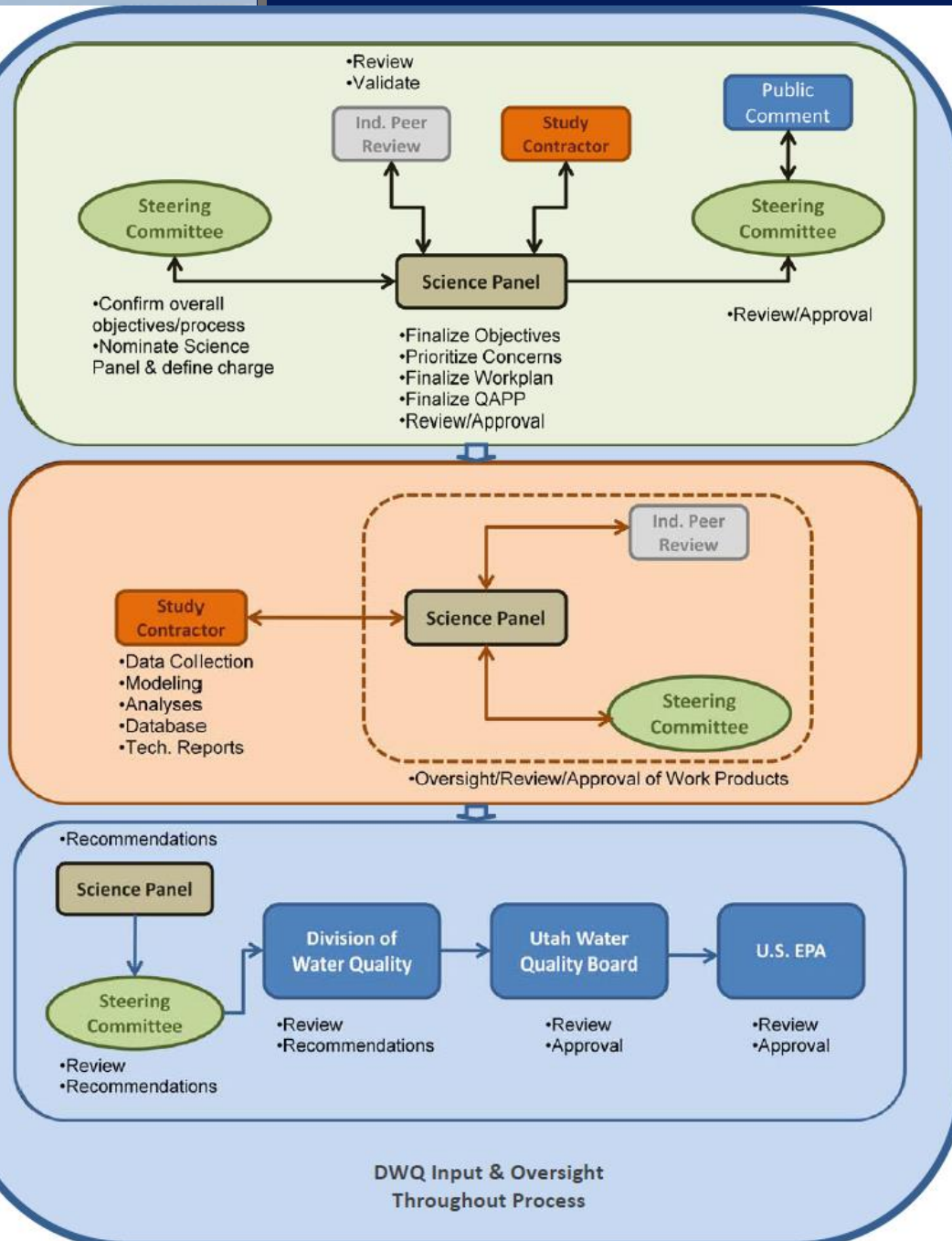
- Define a New Use Class: Wetlands
  - Willard Spur as an Example
  - Site-Specific Narrative?
- Enhanced Wetland Class?

*Continued Steering Committee  
Engagement?*



# Path to Completion 2011

## Plan Formulation



## 2012-2013 Research & Evaluation

## 2015-2016 Reporting & Recommendations

